FAA | AVIATION NEWS

FEBRUARY 1964

F E D E R A L A V I A T I O N A G E N C Y

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VOL. 2, NO. 10 FEBRUARY 1964

COVER

Lockheed C-141 StarLifter, on maiden flight, undergoing s'multaneous tests for FAA certification as a civil cargo carrier and to meet military specifications.

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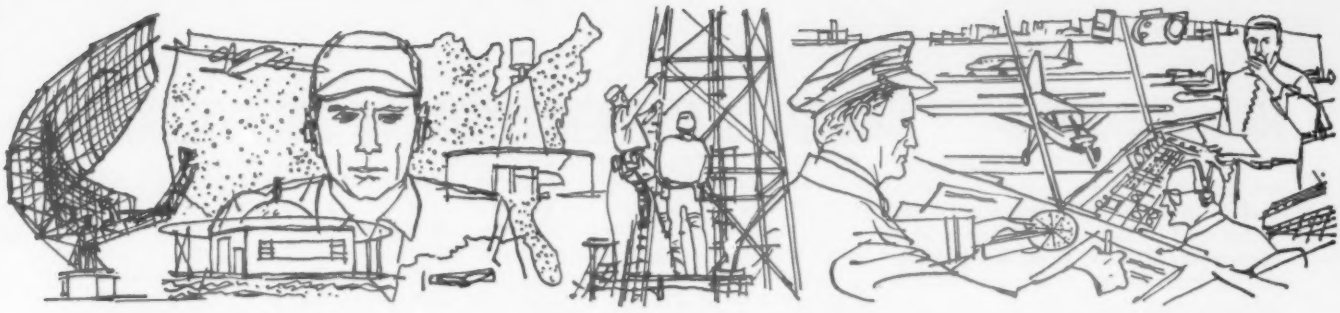


STUDY LAUNCHED TO DETERMINE PUBLIC ACCEPTANCE OF SST SONIC BOOM

A supersonic transport sonic boom study commences in the Oklahoma City, Okla., area this month.

Primary purpose of the 26-week study program is to determine the public acceptability of sonic boom overpressures at the moderate levels predicted for supersonic transport operations.

Data compiled could have great significance in design and operation of United States and foreign supersonic transports, which are expected to be in airline service in the 1970's. The Nation's SST program is now in the design stage. Manufacturers' design proposals are currently being evaluated by ten airlines and 210-member government evaluation group (*see page 4.*)

Gordon M. Bain, FAA Deputy Administrator for Supersonic Transport Development, announced the boom study last month in Oklahoma City. He said:

"Sonic boom represents one of the potential problems as we look to development and operation of a supersonic transport. A substantial amount of effort has been devoted to exploring sonic boom in the past, both in this country and abroad. We now have a clear picture of the relationship between magnitude of boom and such factors as the speed, mass and altitude of the supersonic aircraft that generates the boom. We can predict boom

Lockheed F-104 to be used in sonic boom studies.

quite accurately on the basis of these factors, and measure it precisely with ground instrumentation. The present firm restrictions on boom levels in design of the SST were established largely on the basis of experimental work by the aeronautical researchers, engineers and flight test personnel who have been concerned with the sonic boom phenomenon.

"Now it is time, building on the foundation of these continuing efforts, to identify any problems associated with the levels of boom we expect from the SST. This Oklahoma City study should help considerably to define the levels of public acceptability."

FAA will investigate any responsible damage claims that may be made as a result of booms in this program. The government will pay the cost of repairs for any verified damage that may be caused directly by the booms. Damage, however, is not expected at the levels of boom in this program. There has been no evidence of injuries to persons or animals from booms in the past.

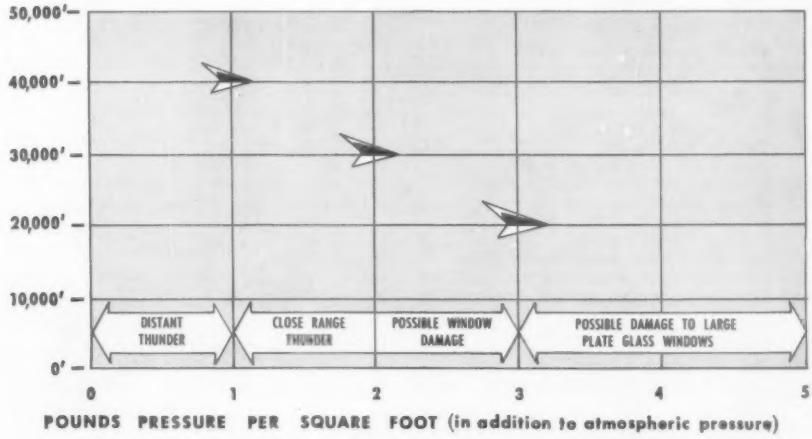
The Federal Aviation Agency will conduct the study program with the coparticipation of the National Aeronautics and Space Administration and the Air Force. Air Force F-104 aircraft will generate the booms, NASA researchers will provide ground instrumentation to measure booms and boom effects.

Local authorities in Oklahoma City have cooperated fully in establishing the sonic boom program. Two major FAA facilities are located there. The Aeronautical Center is the main FAA training and maintenance complex. The Civil Aeromedical Research Institute (*see page 7*) is the foremost institution in the world dealing with medical and human factors in civil aviation. Tinker Air Force Base, from which the boom-study F-104's will operate, is within the city limits, and other major air bases are located in the general vicinity.

A public interviewing program will be conducted throughout the Oklahoma City area during the latter phases of the study by the National Opinion Research Council of the University of Chicago under contract to FAA. FAA personnel in Oklahoma City are prepared to answer inquiries from the public in connection with the program.

One of the important aspects of the program will be to continue the study of possible effects of boom on structures. Four houses of varying types and geographical locations in the Oklahoma City area have been rented for this purpose. One of them will be fully instrumented to determine precisely any structural effects of sonic boom overpressures. The houses will be inspected before and after each boom run.

One F-104 boom run in the program takes place on February 3, southwest to northeast over Oklahoma City, at 10:30 a.m. The level of boom will be maintained at one pound for runs through the re-



SST SONIC BOOM *(continued)*

mainder of the first week of testing. There will be two such runs February 4, three on February 5, four on February 6, five on February 7, and seven each on February 8 and 9. All flights scheduled throughout the program will take place between 7:00 a.m. and 6:00 p.m.

On February 10, the first day of the program's second week, eight flights will be flown, each generating 1.5 pounds overpressure. This is the maximum cruising sonic boom specified in the FAA Request for Proposals establishing design objectives for the supersonic transport.

The F-104's will fly between 30,000 and 40,000 feet on boom runs throughout the program.

A final report of the sonic boom study will be prepared by FAA, NASA and the Air Force at completion of the program. It should be available in the latter part of 1964.

Sonic boom is defined as a strong pressure wave through the air created by an aircraft moving at or above the speed of sound. The boom propagates from the plane much as ripples emanate from an object thrown into a still pond. The waves form in two cones extending back from the nose and tail of the plane.

The strength of shock waves when they reach the surface of the earth is dependent on a number of variables. These include speed, size, geometry and weight of the generating aircraft; its distance or altitude from the earth's surface; and atmospheric and wind conditions. Some flight maneuvers conducted by generating aircraft also increase pressure waves. A sharply turning aircraft, for example, sets up a higher pressure than one flying straight and level.

The sonic wave, dependent on these variables, can range in noise level from inaudible to overpressures that have been likened to a thunderclap, a discharging shotgun or an artillery piece. The cone of waves from the nose and that from the tail can each produce a separate effect, or the two can in other cases blend into a single sound.

FAA, NASA and the Defense Department began joint sonic boom research some years ago. Extensive and continuing studies, which have included sonic boom flights at Holloman AFB, N.M., the NASA Wallops Station in Virginia, and at Edwards AFB, Calif., area have examined the basic overpressure phenomenon, the relationship between aircraft types and operational profiles and resultant boom, effects on ground structures and light aircraft both on the ground and airborne, and factors in the design and operation of future aircraft.

INITIAL SST DESIGNS SUBMITTED FOR EVALUATION

Six aviation companies—three airframe manufacturers and three engine builders—last month submitted initial design proposals for the U. S. supersonic transport.

The three airframe manufacturers are Lockheed Aircraft, The Boeing Company and North American Aviation. The engine builders are Curtiss-Wright, General Electric and the Pratt & Whitney Division of United Aircraft.

Gordon M. Bain, FAA Deputy Administrator for Supersonic Transport Development, said in announcing receipt of the initial designs, "It is very evident, even at this stage, that the manufacturers have devoted intensive effort to development of their proposals. Now we commence the most comprehensive evaluation in the history of commercial air transportation."

The substance of these proposals for the airframe and engines of the SST will not be made public at this time.

The initial design proposals were submitted in accordance with the SST program timetable established in the FAA Request for Proposals of August 15, 1963. January 15, 1964 was set as the deadline for submission. The six companies, also in line with the RFP schedule, notified FAA in September of intent to submit proposals.

Evaluation will be conducted by a 210-member Supersonic Transport Evaluation Group composed of top technical personnel of the FAA, the National Aeronautics and Space Administration, the Air Force, the Navy, the Civil Aeronautics Board and the Department of Commerce. The group is scheduled to complete its intensive analysis and evaluation of proposals in the technical, operational, management and economics area by early March.

Ten airlines will conduct independent evaluations. These airlines are American Airlines, Braniff Airways, Continental Air Lines, Delta Air Lines, Eastern Airlines, National Airlines, Northwest Airlines, Pan American World Airways, Trans World Airlines and United Air Lines.

The airlines will submit the results of their evaluations to FAA by March 18. Government and airline evaluations will be formally reviewed in joint Government-airline discussions scheduled for March 25 and 26 in Washington.

On the basis of this Government-airline design-evaluation process, FAA Administrator N. E. Halaby will announce selection of airframe and engine contractors to proceed with development of the SST, or to continue through a year-long phase of detailed design competition, by May 1. If no proposals meet the requisite technical and economic design criteria established in the Request for Proposals, the program may be redirected.

FAA FACILITIES KEEP PACE WITH AVIATION GROWTH

FACILITY	Commissioned as of 12/31/58	12/31/62	12/31/63
Air Route Traffic Control Centers (ARTCC)	33	35	32
Long Range Radar (LRR)	15	62	74
Air Traffic Control Radar Beacon System/Long Range Radar (ATCRBS/LRR)	0	57	75
Airport Surveillance Radar (ASR)	47	69	70
Air Traffic Control Radar Beacon System/Arpt. Surv. Radar (ATCRBS/ASR)	0	7	15
VORTAC	19	302	309
En Route VOR	556	474	511
Terminal VOR (TVOR)	10	56	79
Instrument Landing System (ILS)	171	228	235
Approach Light System (ALS)	51	110	193
Airport Control Towers	212	269	276
Precision Approach Radar (PAR)	10	29	30
Peripheral Communications	236	296	317
International Flight Service Station (IFSS)	12	11	11
Airport Surface Detection Equipment (ASDE)	0	10	11
Visual Approach Slope Indicator System (VASI)	0	36	39
Total aircraft operations	26,593,337	28,200,570	*30,633,000
General Aviation aircraft operations	14,032,448	17,367,249	*19,630,000
Total IFR aircraft handled	9,009,290	10,056,217	*10,560,000
General Aviation IFR aircraft handled	535,517	920,164	*927,000

*Estimated

SENSE OF TOUCH HELPS BLIND AVIATION MECHANIC OVERCOME HANDICAP

For Joe Pasqua of Frontier Airlines, the dark is light enough.

Joe is a 34-year-old aviation mechanic (FAA certificate 699169) with Frontier —a local service carrier based at Denver.

He also is blind—probably the only sightless aviation mechanic working at his trade in the United States.

Blindness is still new to Joe Pasqua. He lived a normal life for some 30 years before an infection claimed his sight. Two-and-a-half years ago, his right eye had to be removed and he was left with only a slight light perception in the other eye.

At first the darkness was unendurable. Then the Colorado State Department of Rehabilitation and Service for the Blind stepped in with an intangible called hope. A retraining program was arranged, and Joe found that the skills acquired during 15 years as an aviation mechanic had not deserted him during these dark days.

In June, 1962, Joe returned to Frontier on a part-time basis. Progress was slow at first, but he soon learned to handle himself and his job with confidence.

And he did more than just learn. Because blindness limited him to certain areas, he redesigned his tool boards. These changes later were adopted by the whole maintenance shop and resulted in improved all-around operations.

A Denver resident and father of three, Joe long since has returned to full-time duty with Frontier. Working in engine overhaul, he strips down five giant 1400-horsepower piston engines a month.

On the job he is treated much like any other aviation mechanic in the maintenance shop.

Joe Pasqua won't have it otherwise.

PILOT-TO-FORECASTER WEATHER SERVICE EXPANDED

A network of five Flight Service Stations has been added to the Kansas City, Mo., direct pilot-to-forecaster weather service, making it available to all radio-equipped aircraft operating in the expanded Kansas City area.

Airborne pilots can now directly contact a Weather Bureau forecaster in Kansas City through Flight Service Stations at Salina, Kansas; Des Moines; and the Kansas City, Columbia and Joplin stations in Missouri.

The hook-up between the five stations and the forecaster is made via phone patch landlines.

Pilots may use standard Flight Service Station radio frequencies to reach the forecaster. The frequency FAA prefers pilots to use is 135.9 mc. If not equipped with 135.9 mc, pilots should use 122.1/ VOR or, as third choice, 126.7 mc. If close to Kansas City, the contact with the forecaster can be made directly on 122.6 mc. UHF-equipped aircraft may use 255.4 mc to contact the forecaster, regardless of altitude.

One aviation meteorologist is on duty around-the-clock. He can talk to only one pilot at a time so that some delay may be encountered by pilots in reaching him. When the connection is made, the pilot should be prepared to provide the forecaster with certain basic information concerning his flight to help the forecaster. This information should state whether the flight is IFR or VFR, altitude, route and destination of flight, etc.

Pilot-to-forecaster service is designed for air-ground contacts only and does not include preflight weather briefings by phone. These and other requests for routine type weather information should continue to be directed to the FAA weather briefer at the Flight Service Station. Direct forecaster service is intended to meet in-flight situations in which the pilot encounters critical or rapidly changing weather requiring direct advice from a meteorologist.

An evaluation of the pilot-to-forecaster program is being conducted under contract for the FAA by the American Institute for Research in Pittsburgh. Pilots' comments can aid in the evaluation, which will be used to determine the feasibility of making the service available elsewhere. In this connection, pilots may call the Pittsburgh research office at (412) 681-3001 after landing, Monday through Friday, between the hours of 1400 and 2200 GMT. Their comments will be held in confidence.

The same service being provided in the Washington Air Route Traffic Control Center area is also under study by the Pittsburgh firm and it will accept calls from pilots on that program. The Washington forecaster is located at the FAA ARTCC and can be contacted directly on 122.6 mcs. for special advice when confronted by unusual weather situations. Pilots operating in areas near Elkins, W. Va.; Richmond, Front Royal and Roanoke, Va.; or Rocky Mount, N.C., may obtain direct pilot-to-forecaster weather service.

Agency Official Honored for His Contributions to General Aviation

William J. Schulte (*left*), Assistant Administrator of FAA's Office of General Aviation Affairs, was honored by the National Aviation Trades Association at its annual convention in Miami.

Presenting the award to Mr. Schulte is Samuel Freeman, president of NATA.

The NATA award cited the FAA official for "his outstanding contributions which have achieved better relationships between government and industry and advanced the cause of general aviation."

Schulte has been active in general aviation for more than 30 years. He holds a commercial pilot's license and has logged more than 3,000 hours.

"TALKING" ROBOT CONTROLLERS TRIED AT 2 SITES

Robot controllers who "never tire of talking" may be available at 35 different sites across the nation if current tests are successful.

Two facilities, the TVOR at San Francisco and the VORTAC at Chicago's O'Hare, are the first to test the system which provides automatically broadcast routine non-control information to pilots. The taped information given to the pilots includes the latest airport weather data, operational runway, method of approach and pertinent NOTAMS.

The robots relieve controllers from many repetitious reports and are expected to thin-out frequency congestion and provide better approach control for aircraft.

Early reports on the tests indicate a favorable response.

MILESTONES IN AVIATION

The early feats of the Wright Brothers and other pioneers in powered flight were transmitted overseas by the lectures of America's unofficial aviation ambassador, Octave Chanute. As a result, an inspired Europe began to shift from gliders and kites to powered flight in 1903.

It wasn't until 1906, however, after several men had made unsuccessful attempts, that a Brazilian-born Parisian, Alberto Santos-Dumont, who had experimented with odd-shaped, gas-filled airships (semi-rigid types), was able to achieve powered flight abroad.

Santos-Dumont's successful *14-bis* was first tested in July, 1906, slung under his airship No. 14. On his second test, the plane was suspended from a trolley running on an overhead wire.

On September 13, 1906, Santos-Dumont made his first "free hop"—23 feet near Bagatelle, France—earning the distinction of having achieved Europe's first official powered flight.

On succeeding flights, he covered about 197 feet and later he traveled 722 feet in 21 seconds, winning the French Aero Club's prize for the first flight of 100 meters.

The *14-bis* had cellular box-kite wings of 860 square feet which were set at a pronounced dihedral angle. They were placed oddly in the rear. A large box-kite cell which was located at the front end (*right in photo*) of a long covered fuselage served as a combined elevator and rudder.

The biplane caused a sensation and was heralded as the arrival of powered flight in Europe. However, it did little to promote or influence European aviation and was abandoned after a short flight in April, 1907.

Comments Sought on FAA Program To Develop Crash Locator Beacon

A program to encourage the development and use of crash locator beacons has been announced by FAA.

George S. Moore, Director of FAA's Flight Standards Service, said that tests conducted by the Agency "clearly indicated that such a beacon can successfully radiate energy to permit suitably equipped search aircraft to identify and 'home-in' on the transmitted signal."

Before proceeding further with the program, Moore added, FAA must have assurances that industry can produce crash locator beacons at a reasonably low price and that individual aircraft owners would buy or rent such equipment.

Should the response prove favorable, FAA then would proceed with plans to install search equipment in most of the aircraft used by the Agency for flight inspection of air navigation aids. The search equipment would be operated throughout routine missions ready to pick up emergency signals from any downed aircraft. The FAA aircraft also would be available for special search missions.

To be fully compatible with search equipment installed in FAA aircraft, crash locator beacons would need the following characteristics:

- **Power output**—at least 225 milliwatts.
- **Output duration**—24 to 48 hours.
- **Transmitting frequency**—121.5 megacycles, crystal controlled with audio tone sweeping between 2000-2300 cycles two to three times a second; 70-90 per cent modulation.

A successful evaluation of crash locator beacons was conducted last summer on the West Coast using two FAA DC-3s. Signals from beacon equipment with a power output of 175 milliwatts, for example, were received from a distance of 30 miles at 1,000 feet altitude, 50 miles at 5,000 feet and 65 miles at 10,000.

The equipment used in the tests did not represent all available types but included crash locator beacons from Dominion Scientific Instrument Ltd. of Ottawa, Canada, and emergency radio transmitters from National Aeronautical Corp. (NARCO) and Douglas Aircraft Co.

FAA is not attempting at this time to recommend any particular type of beacon equipment. The purpose of the present inquiry is merely to determine the acceptance of crash locator beacons in the nation's emergency search system.

Researchers study stress: Left, checking lung capacity of subject exercising on treadmill. Right, telemetry transmits heart action.

FAA Medical Researchers Probe Modern Day Flight Problems

This is the second article in a three-part series on the Federal Aviation Agency's Aeronautical Center in Oklahoma City.

A variety of jet-age medical problems affecting aviation are under the scrutiny of scientists at FAA's Civil Aeromedical Research Institute (CARI). The objective is age-old: To provide safer flight for both crewmember and passenger.

CARI laboratories were tailor-made to meet some of the problems of modern flight. High altitude studies, for example, are conducted in a chamber capable of reaching a simulated 150,000-foot altitude—more than twice the altitude expected from the supersonic transport of the 1970s. In another chamber the climate can be controlled through a wide range: temperature from —80° F. to 180° F., humidity levels from zero to 100 per cent, wind velocity to a blustery 50 knots.

Every physiological laboratory in the building has its own fine-control air conditioning, water temperature control, vacuum attachments, fume-hood facilities, closed circuit TV conduits, and other special built-in equipment.

In the basement master control room an indicator detects any temperature variation within one-half of one degree which might occur in a particular laboratory.

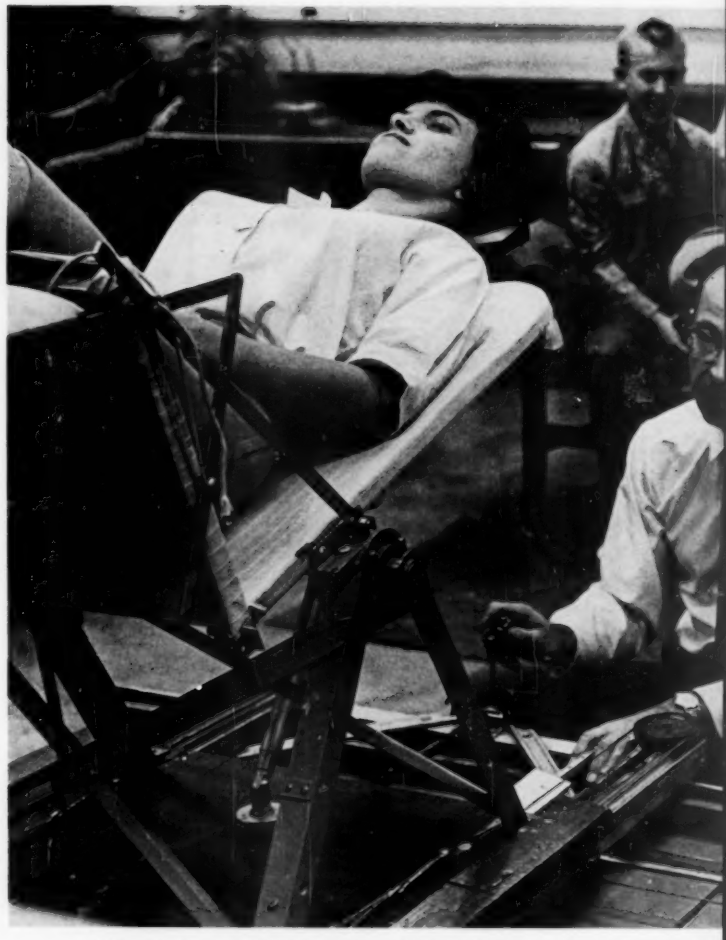
This specialized environment is only the form; the substance is the day-to-day work of the research scientist:

- Engineers have made thousands of measurements to collect information that may product safer, more efficient seat belts and seats, particularly for children and infants.

A study of certain airplane interiors disclosed a serious shortcoming—they were capable of causing puncture-wounds during crash deceleration. As an outgrowth of the study, safer interiors were designed.

- Ditching studies are conducted in a 40 x 40 tank where the water temperature can be varied between 34° and 120°, room temperatures from freezing to 120°, and humidity from zero to 100 per cent. Complete darkness can be simulated for night ditching studies and underwater movies may be made through the windows in the side of the tank.

Various ditching tests, in 18 feet of water, simulate actual crashes at sea. Aircraft exits, including cockpit windows, are measured and studied, to determine the best way for passen-



Left and above: Taking body measurements of children to determine safest airp

gers and crew to leave a downed plane. Researchers also test various life rafts and vests, pillows and seat cushions, to determine the most practical flotation devices for men, women and children after a ditching.

• FAA researchers also are trying to shed light on an old problem: How to illuminate the inky blackness of night in order to rescue passengers from an airplane ditched at sea.

Currently under study are two bright prospects—a safe, radioactive tritium light that glows in the dark and xenon lamps of near-sunlight brilliance.

The tritium lamps, which emit a phosphorescent glow in the dark, are designed to be installed around life rafts. Because the radioactive gas is self-luminous, the tritium lamp does not have to be exposed to light in order to initiate a glow. And since the light source is self-contained, life rafts with tritium lamps may be stored for lengthy periods without worrying about power failure.

The "sunlight" xenon lamps being tested are attached to life

t and seat belt configurations.

Above, installing xenon light on raft. Below, camera is used to photograph instruments in study of pilot stress.

Above, spinal x-rays are examined in impact study. Below, research on toxicity of insecticides used in crop dusting.

jackets where their brilliant intermittent flashes can be quickly spotted by rescuers.

Although the tritium light sources used around life rafts use a radioactive isotope of hydrogen, they pose no danger. If the three-inch hairline tube breaks, the gas will dissipate and turn back to hydrogen.

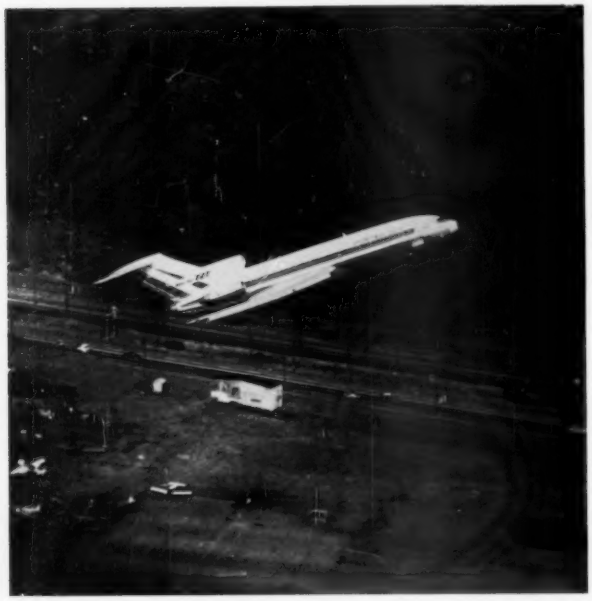
Xenon lights used on life jackets have a service life of eight hours. Used on life rafts, they will flash for 36 hours.

- The toxic hazards of crop-dusting, or aerial application, are being continually examined as are problems of radiation and ozone toxicity at high altitudes.
- Other research projects are concerned with how the human body reacts under various stresses and strains as related to the fitness and efficiency of air traffic controllers. Individual controllers are studied on-the-job. In-flight tests to check heart reaction and nervous tension are made in CARI's T-34 aircraft. Radio telemetry transmits the data to receiving equipment in the CARI building during flight.

By using certain key psychological tests, it now is possible to predict, with a high degree of confidence, the chances for a controller-trainee to complete the course of training. Of particular significance are the tests that determine a prospective student's abilities in abstract reasoning. These involve 44 tests to demonstrate the trainee's ability with a series of numbers, the ability to think "three-dimensionally," and a series of special tests in handling hypothetical air traffic situations.

Another project deals with the aging factor in airmen. This geriatrics study, for the most part, is being done in the Georgetown Medical Center in Washington, D. C.

With the development of the next generation of civil aircraft, from the supersonic transport and the vertical take-off and land aircraft, to the sports and business planes of private aviation, CARI research will continue to explore the unknown. CARI is meeting the needs of tomorrow's aviation by contributing to the FAA mission of safety in flight and fostering the growth of civil aviation.



Sleek Boeing 727 can take off from 5,000-ft. runway, cruise at 575 mph.

Above and below: FAA pilots who took familiarization training on 727.

AERIAL NEWCOMER

A new transport, the three-jet Boeing 727, flies the skies today ● More than three years ago, while the 727 was still on the drawing boards, the task of type certification by the Federal Aviation Agency was initiated ● Beginning with familiarization sessions, the FAA Type Certification Board met with Boeing engineers to establish a basis for certification. In the 3½ years prior to certification, tremendous amounts of data -- drawings, specifications and analyses -- were studied by FAA engineering and manufacturing personnel. The objective was to verify that the manufacturer had complied with all the applicable provisions of Part 4b of the Civil Air Regulations pertaining to transport design ● In the process the FAA provided technical counsel, interpretation of FAA requirements and observed and participated in numerous tests of airframe and systems components ● Three 727 transports were used to make static, fatigue and flight tests. One jet was 'tested to destruction' in the laboratory to determine the extreme strength limits after it first met all standard requirements. Another plane was subjected to variable, repeated loads to seek out any critical fatigue areas. FAA test pilots 'rung out' the 727 on exhaustive tests to see that its performance complied with all required conditions. Function and reliability tests conducted on the transport took the FAA team on a 94,000 mile cross-country flight.

Bottom left and clockwise: FAA manufacturing inspectors note flap construction; examining control cables; FAA pilots get lecture from Boeing instructor; company officials brief FAA Administrator N.E. Halaby *(center)* on their new jet; as part of FAA certification, artifical ice shapes were installed to check plane's handling characteristics; after 11 months of extensive testing, FAA type certificate is awarded.

WIND

This is the 11th in a series of articles on aviation weather prepared by the meteorologists of the Weather Bureau.

Wind is simply air in motion, but this invisible weather element affects all flights from start to finish.

The direction and speed of the wind are determined by a combination of many factors. Atmospheric pressure is one of the most significant. Pressure, largely generated by heat from the sun, is distributed unevenly over the earth's surface. Just as water flows downhill, air moves from centers of high pressure toward areas of low presure. *The greater the difference in pressure between two neighboring air masses, the stronger the wind will be.*

Gravity, surface friction, centrifugal force, and the earth's rotation also exert their influence on wind direction and speed. When all of these are added to the complex factors that control the general circulation of the atmosphere on this rotating planet, an explanation of how the wind blows becomes anything but simple.

For the operating pilot, who doesn't need to know all the meteorological why's and wherefore's, a few rules of thumb borrowed from the weatherman's wind book can be helpful:

Rule 1. Wind blows from high to low pressure.

Rule 2. The greater the difference between high and low pressure centers, the stronger the wind.

Rule 3. In general, the prevailing winds that move storm systems across North America blow from west to east.

Rule 4. Winds blow clockwise around a high pressure system and counterclockwise around a low.

These four rules explain quite a few wind phenomena and may assist the pilot when he has to evaluate a weather situation independently and make a flight decision on his own.

The most favorable flight altitude often depends on upper winds. Information on these winds at various flight levels is contained in aviation weather reports and forecasts.

Wind speed and direction above the earth's surface are measured by tracking balloons visually or electronically. Small pilot balloons, inflated with a fixed amount of helium, are tracked visually with an instrument called a theodolite, which is similar to a surveyor's transit. Since the normal ascension rate of the balloon is known, the charted path of the balloon can be used to determine the direction and speed of the wind at various levels. Wind measurements cannot be obtained by the visual method when the balloon is above the clouds.

But modern technology has provided a more efficient technique for measuring upper winds in all weather. Automatic radio-direction-finding equipment can track balloon-borne instruments to high levels and great distances.

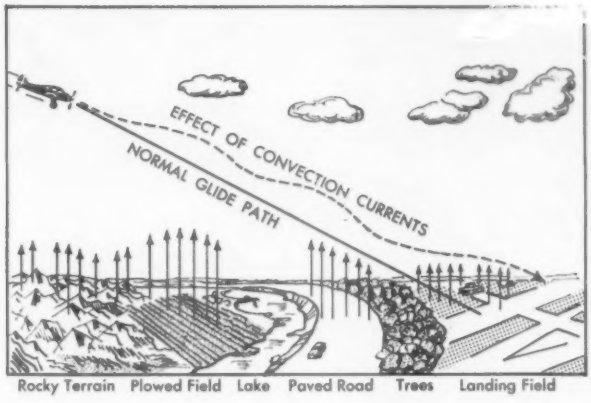
All pilots are familiar with the variations in wind speed and direction at different altitudes. These variations are the rule rather than the exception. Occasionally, wind directions may be exactly opposed and speeds may differ considerably over a short distance. In active thunderstorms and extreme frontal situations, wind speeds may differ by 50 knots or more within a few hundred feet horizontally or vertically. In air free of clouds, this variation in speed may occur within a few thousand feet vertically and a few score miles horizontally.

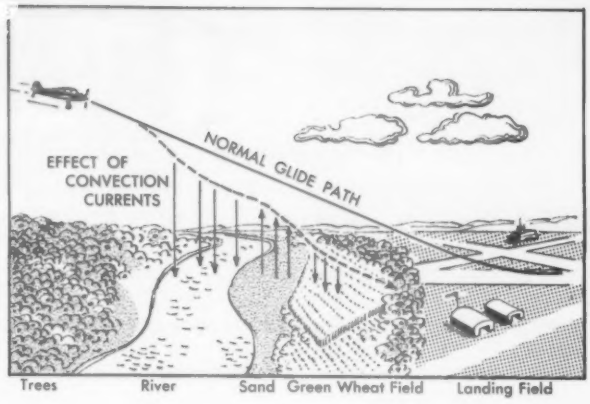
Between streams of air blowing in different directions or at different speeds, a phenomenon called *wind shear* develops. Wind shear causes turbulence, which is strongest where the shears are greatest. This type of turbulence often occurs where there are no clouds and therefore is called clear air turbulence or CAT. CAT is one of the serious problems encountered in operation of high-performance aircraft.

Closer to the earth, wind flow is influenced greatly by convection and terrain or man-made obstacles (*top of next page*). *Convection currents* are small, local, vertical circulations, caused by variations in heat given off by different kinds of surfaces. Plowed ground, sand, rocks and barren land give off a great deal of heat. Water and vegetation do not. *The vertical currents created by these differences can seriously affect small aircraft approaching a landing field.* On hot summer afternoons, strong convective currents may extend upward through 10,000 feet or more.

Terrain or obstacles produce eddies in the air that also have considerable effect on the flying characteristics of a plane landing or taking off. These eddies usually are confined to the few thousand feet nearest the surface.

Vertical currents and eddies both act to disturb the smooth flow of wind and cause gustiness and turbulence. Stronger winds and rougher terrain produce heavier turbulence through a deeper layer of air.





Surface winds determine the direction of takeoff and landing. The force of surface wind is measured by an anemometer, and the direction is indicated by a vane that points into the wind.

Each year, small planes are damaged, and their pilots and passengers injured or killed, while landing when surface winds are erratic, shifting and gusty. Most of these accidents occur because the pilot does not have full knowledge of surface wind conditions and is unprepared to take corrective action.

Many small aircraft operate from uncontrolled airports, without tower or weather facilities. Pilots using such fields should observe local wind characteristics carefully and look for visual wind indications to use during approach and landing.

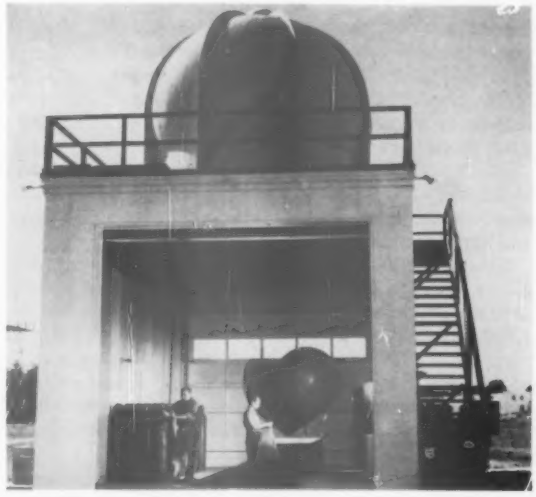
Every airport has a wind sock or a tetrahedron. These simple instruments align themselves with the wind flow and indicate *the direction from which the wind is blowing.* The pilot should know exactly where the wind sock or tetrahedron is located on his home field. At a strange field without tower facilities, he should locate the wind indicator before attempting to land. A reasonable estimate of wind speed can be made from the degree of extension of the sock, although wind socks are not uniform at all airports. When a sock is fully extended, however, winds in excess of 15-20 knots can be expected. If the wind is variable in direction, the wind sock will oscillate from side to side. If the wind is gusty, the sock will oscillate up and down. In strong, gusty winds, the end of the wind sock will flap very rapidly from side to side and up and down, warning the pilot to use every precaution in the landing.

Where there is no wind sock, wind direction can be judged by observing smoke, dust, flags or clothes on a clothesline. The degree of roughness or turbulence in the low levels is some measure of the strength of surface wind, because turbulence increases with wind speed.

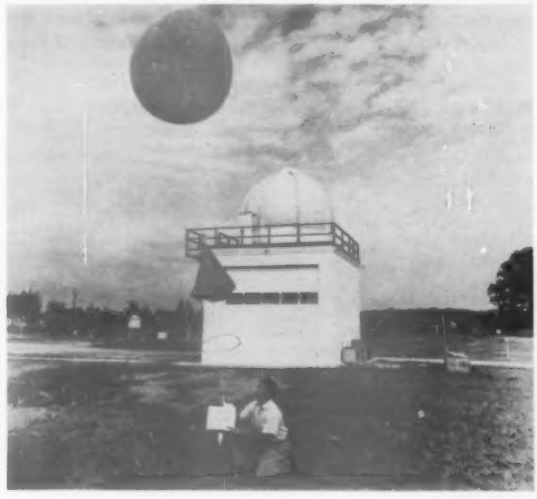
The Beaufort Scale of wind equivalents can be a big help to the small plane pilot who does most of his flying from uncontrolled fields.

A few minutes spent in memorizing the scale could prevent a scraped wing tip or broken landing gear.

Never bet your life that the wind will stay constant in direction or speed. It usually doesn't.



Balloon is filled with gas to lift instruments into upper air to measure temperature, barometric pressure, humidity. Wind direction, speed are computed by tracking radio signals from transmitter.



SAFETY FIRST

Loads and Load Factors

The basic principles of flight are the ones most easily overlooked.

Of these, none is more important to safety than aircraft loads and load factors.

The strength of an airplane is measured basically by the total load which the wings can support without permanent damage. The load imposed upon the wing depends largely upon the type of flight in which the aircraft is engaged. The wing must support not only the weight of the airplane but also the additional loads imposed during maneuvers.

In straight-and-level flight, the wing supports a weight equal to the airplane and its contents. As long as the airplane is moving at a constant speed in a straight line, the load on the wing remains constant.

During a turn-and-bank, however, the load increases due to the build-up of centrifugal force. The load doubles in a 60-degree bank, increases almost three times in a 70-degree bank, and almost six times in an 80-degree bank.

Similar increases in load may be caused by pull-outs from a dive. At high speeds, these loads may exceed the structural strength of the wing. For example, if an airplane weighing 1,100 pounds were dived at 200 miles per hour and pulled out abruptly, the load on the wing (assuming it stayed on) would be 25 times the weight of the airplane—almost 14 tons!

Another cause of large load factors is rough air. Violent gusts encountered at high speeds may temporarily increase loads four or five times.

Some airplanes have an accelerometer to measure wing loads, but most pilots must rely on the seat of their pants. As load increases, the effective weight of the pilot increases. This added weight can be easily sensed and is a fairly reliable guide to indicated increases up to twice the normal load. As the load approaches three times normal, the pilot will notice a sensation of blood draining from the head and a tendency of the cheeks to sag. A considerably greater increase in load may cause a "dim out" or "black out."

The amount of excess load which can be imposed upon the wing depends upon the speed of the airplane. At high speeds, a sudden movement of the controls or a strong gust may increase the load beyond safe limits. Because of this relationship between speed and safety, certain maximum speeds have been established, and every airplane is restricted accordingly.

As a reminder to pilots, the air-speed indicator in all modern aircraft is marked to show speed limitations at a glance.

The *never-exceed speed* is designated by a red radial line. This is the maximum at which the airplane can be operated in smooth air. Pilots should not exceed this speed intentionally. However, if the airplane should approach this speed inadvertently in a dive or acrobatic maneuver, it should be handled very carefully and the pull-out made slowly and gently.

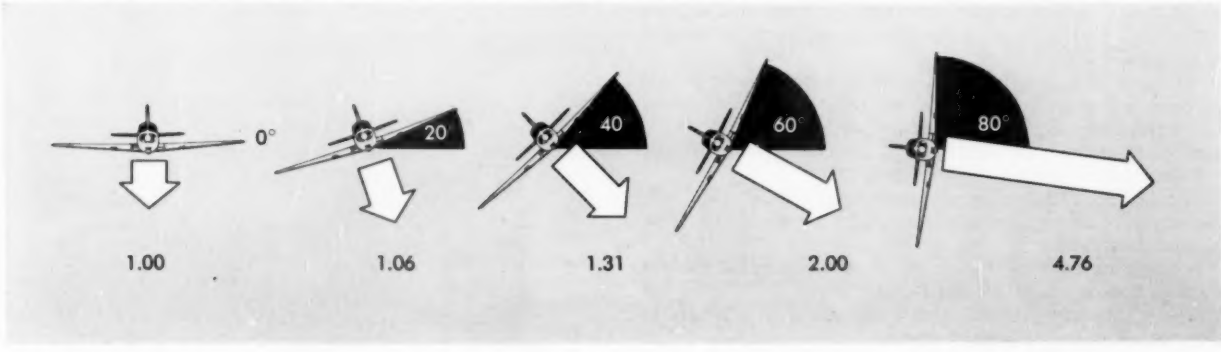
A *cautionary range* between never-exceed speed and maximum normal operating speed is shown by a yellow arc. The range from a *normal operating speed* to *normal stalling speed* is shown by a green arc. If the airplane is equipped with flaps, the *flap operating range* is shown by a white arc.

There also are other important airspeed limitations not marked on the face of the airspeed indicator. These speeds are generally found on placards in view of the pilot and in the *Airplane Flight Manual* or owner's handbook.

Of primary importance is the maneuvering speeds. This is the pilot's "rough air" speed and the maximum speed for abrupt maneuvers. If rough air or severe turbulence is met during flight, the airspeed should be reduced to maneuvering speed or less in order to reduce the stress upon the airplane structure.

For safe flying, the pilot should familiarize himself with all the limitations affecting the structural integrity of his airplane. What's more, he should heed them.

Load on the wings increases when the angle of bank increases. The rate of increase in shown by the length of the arrows. Figures below arrows indicate the increase in terms of airplane weight. For example, the load during a 60 degree bank is 2.00, or twice the weight of the airplane in level flight.



Letters

FAA

FAA Aviation News welcomes comments from the aviation community. We will reserve this page for an exchange of views. Please keep them brief. No anonymous letters will be used, but names will be withheld on request.

• Aircraft Registration

Please give me any information you have regarding FAA regulations concerning ownership of private aircraft by aliens.

George S. Fralin, Jr.
Lynchburg, Va.

This subject is covered in the Regulations of the Administrator, *Part 501 (Aircraft Registration Certificates) which specifies that only aircraft owned by U. S. citizens may be registered in this country.*

• Overwater Flight

I am planning to pilot my own plane on a trip to the Bahama Islands and would like to have your opinion regarding safety factors, the best route, point of departures, VOR's, etc.

Franklin L. Carr
Yardly, Pa.

For factual information concerning routes, navigational aids, air-ground voice communications and aerodrome data you are referred to the International Flight Information Manual *and the standard low altitude en route charts.*

Other essential factors to consider are filing a flight plan, ample fuel, weather compatible with your own piloting capabilities, and though not required by regulation (unless for hire or compensation), proper flotation gear to accommodate all occupants of the aircraft.

We would suggest that you discuss your proposed flight with fixed-based operators located at your United States point of departure. Many of these individuals have had extensive operational experience throughout the area which we believe you will find invaluable. Among other things, they will be able to advise you with respect to renting flotation and survival gear in the event you have no need to purchase such equipment.

• Medical Waiver

As a private pilot with a current instrument rating, I like to do as much as I can to increase and maintain my own proficiency primarily for safety.

I recently inquired about a commercial license and found that I needed a Class 2 medical instead of my current and valid Class 3 medical. As it turns out, I cannot meet a Class 2 medical without a waiver, as I must wear corrective lenses.

The point I would like to make is this: Why wouldn't it be possible to make available to pilots who take the time to study and develop their proficiency the equivalent of a commercial license which would be only a certification of proficiency and not permit the recipient to fly professionally? Possibly a commercial proficiency endorsement of a private license after completion of the commercial written and commercial flight test might inspire more pilots to continue to develop their proficiency in spite of the fact that they are limited to a Class 3 medical.

Gordon H. Millar
Moline, Ill.

FAA is actively encouraging recurrent refresher courses and training for additional qualifications for all certificated pilots. We agree that some official recognition of such training and accomplishment would provide a valuable incentive, and we shall consider practical means by which it can be provided.

In your own case, the fact that you have qualified for an instrument rating and believe that visual acuity will not prevent you from meeting the skill requirements for a commercial pilot certificate indicates that you may be able to quality for a waiver of the vision requirements for a second medical certificate. We suggest that you contact your Regional Flight Surgeon at 4825 Troost Avenue, Kansas City, Mo., who can advise you of the procedure for making application for such a waiver.

• Military Flight Time

During 1948-49, I was in pilot training with the U.S. Air Force and logged 206:50 hours. Although I qualified in the AT-6, I did not qualify in the IF-80C and subsequently was removed from further training in this aircraft. I fully realize that although I was on solo flying status at the time of my discharge, I was not a rated pilot or the equivalent and, therefore, cannot obtain any of the pilot certificates by virtue of complying with C. A. R. 20.111 part (2). However, I would like to determine if I may use my accrued flying time in the usual fashion.

O. W. S.
Willimantic, Conn.

Federal Aviation Regulations, *Part 61, "Certification: Pilots and Flight Instructors," supersedes* Civil Air Regulations, *Part 20, to which you referred. Flight time used to meet the experience requirements for any pilot certificate or rating must be shown by a reliable record that satisfies the requirements of F. A. R. Section 61.39.*

Military solo or pilot-in-command flight time may be credited toward total solo flight time requirements. Flight instruction time, however, is acceptable only if given by a holder of a valid flight instructor certificate with appropriate flight instructor rating issued by the Federal Aviation Agency.

• Weather Articles

I have saved most of your "Safety First" articles and consider them to be excellent. I have been following your weather series closely but I failed to save all of them. On the conclusion of the series, I would like to receive the articles as a single reprint if you plan to produce it in that format.

John Nelson,
Puyallup, Wash.

We plan to reprint the weather articles as a separate pamphlet and make it available to pilots. Further details will be announced in FAA Aviation News.

• No Pay Flying

Can I fly rotorcraft in an agriculture applicator operation on a private pilot's license if I receive no remuneration from either the customer or the flying service?

Gary Miller
A.P.O. 864
New York, N.Y.

Section 61.101 (a) of Federal Aviation Regulations, *Part 61, prohibits a private pilot from acting as pilot-in-command of an aircraft for compensation or hire. Therefore, you would not be in violation of this section if you did not receive pay or other remuneration for your services as a pilot.*

It must be pointed out, however, that numerous types of aviation operations, which are conducted under the provisions of operating certificates or certificate of waiver, prohibit the utilization of pilots holding private pilot certificates as pilot-in-command of aircraft.

Detailed information regarding your specific case may be obtained from your nearest General Aviation District Office.

• Foreign Licenses

A few of us in SHAPE are trying to do some private flying with small aircraft in order to obtain a license. I have a French "brevet" 2nd degree which I am told is internationally recognized, including by the US. Others of our club have been told that your Agency does not recognize a French license. Could we have your comments?

Paul F. Shey
Supreme Headquarters,
Allied Powers, Europe,
APO 55
New York, N. Y.

Federal Aviation Regulations *do not provide for the issuance of equivalent U.S. pilot certificates to holders of foreign pilot licenses on the basis of reciprocity. Provision for the issuance of a U.S. pilot certificate is limited to qualified applicants of foreign citizenship only. These requirements are prescribed in section 61.33 of the* Federal Aviation Regulations.

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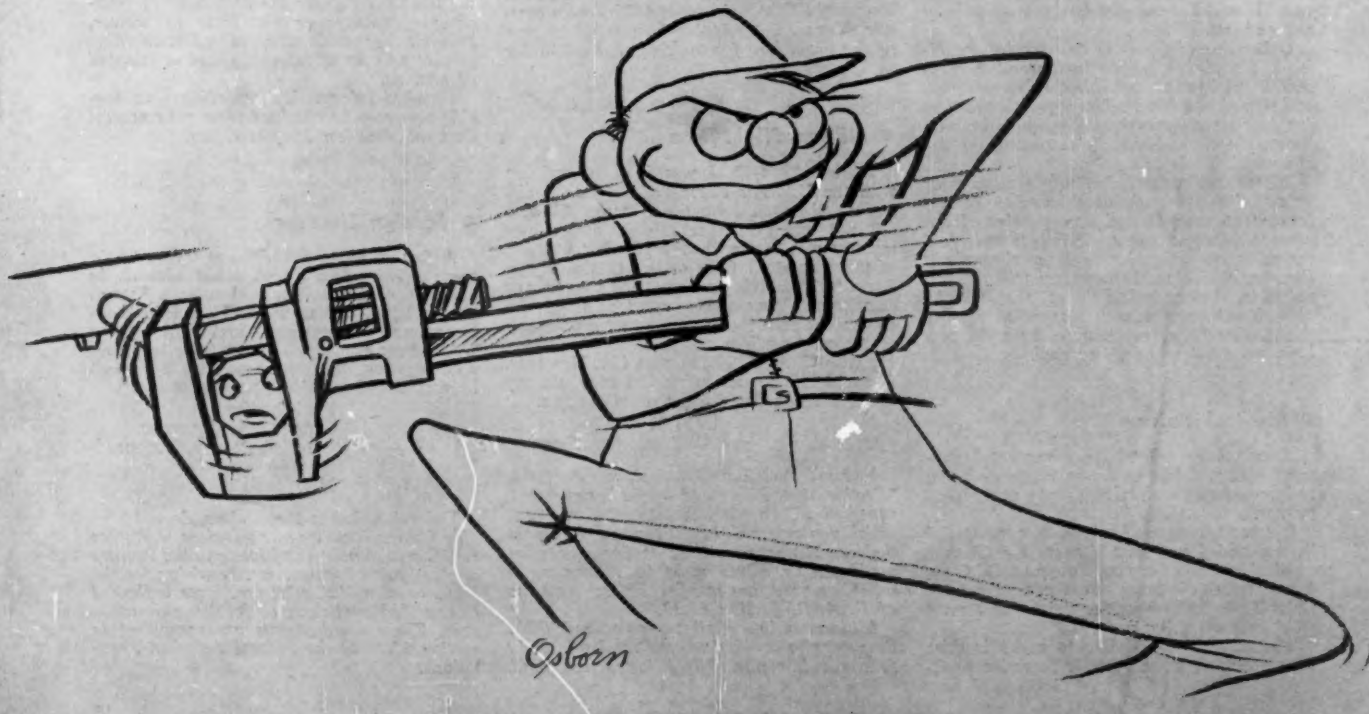
PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

Less muscle, more brain



Use torque, no strain